

CS621: Performance Evaluation

Homework 1

Due Date: Sep 14, 2007, **10:05am in Class**

(No late submissions)

Answers can be Handwritten or Typed

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Show all expressions/calculations in detail and explain how answers were obtained to receive full credit.

1. Consider a system with Poisson arrivals at rate: $\lambda = 16$ customers per second; each server's exponential service time distribution with service rate of 20 customers per second. In order to achieve a blocking probability of 10^{-3} with a M/M/m/m system, what should be the smallest value of m ?
2. Consider a system with Poisson arrivals at rate: $\lambda = 12$ customers per second; each server's exponential service time distribution with service rate of 20 customers per second. In order to achieve a blocking probability of 10^{-5} with a M/M/1/B system, what should be the smallest value of B ?
3. Consider a system with Poisson arrivals at rate: $\lambda = 15$ customers per second; each server's exponential service time distribution with service rate of 20 customers per second. Plot on a single figure the $E[r]$ vs. m (2 to 8) for the two systems: m separate M/M/1 queues, and M/M/m system. Interpret the results of the graph in terms of which system performs better under what conditions?
4. Consider a system with Poisson arrivals at rate: λ customers per second; each server's exponential service time distribution with service rate of 20 customers per second. Plot on a single figure the $E[r]$ vs. λ (from 10 to 50 in increments of 10) for the two systems: 3 separate M/M/1 queues, and M/M/3 system. Interpret the results of the graph in terms of which system performs better under what conditions?
5. Consider a call center that receives calls based on a Poisson process at an average of 720 calls per hour, with an average call duration of 4 minutes, and 55 agents. What is the probability that a calling customer has to wait before being serviced? What is the average waiting time?
6. Problem 31.3 on page 545 of Raj Jain's book.